## Remarks

The Office Action mailed May 5, 2004 has been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 2-3, 5-11, 13-17, 19-25, and 27-37 are now pending in this application. Claims 5, 13, 15, 19, 27, 31, and 32-35 have been amended. Claims 2-3, 5-11, 13-17, 19-25, and 27-37 stand rejected.

A transmittal including a fee calculation is provided for the amended claims because some of the amended claims are being made newly independent. No extension of time is believed to be required for entry of this Amendment. However, if an extension of time and/or additional fees are required for entry of this Amendment, authorization is hereby given to consider this a request for the necessary extension of time and/or to charge the Deposit Account shown on the fee calculation sheet the necessary additional fees to enter this amendment.

The final Office Action to which this Amendment responds is dated May 5, 2004. It is believed that this Amendment is being filed in time to take advantage of the two month period for filing a first reply to the final Office Action inasmuch as July 5, 2004 was a national holiday.

Applicants gratefully acknowledge the acceptance of Figures 3 and 4 that were received by the Office on March 23, 2004.

The rejection of Claims 2-3, 5-11, 13-17, 19-25, and 27-37 under 35 U.S.C. § 112, second paragraph, is respectfully traversed.

In Claim 31, the Office asserted that the term "a mantissa region" in line 3 is unclear. The phrase "a mantissa region between 1 and 2" has been changed to "an interval between 1 and 2." See page 5, lines 16-18 of the specification as originally filed, which recites, "Because mantissa *m* is between 1 and 2, in one embodiment of the present invention, the

region between 1 and 2 is partitioned into *N* equally spaced sub-regions." It is submitted that the term "region between 1 and 2" and "interval between 1 and 2" would be read by one of ordinary skill in the art as being completely synonymous and requiring no further explanation. However, if the Office believes that it is necessary for the claims to recite the term "region" instead of "interval," Applicants would have no objection to an Examiner's amendment making this substitution.

The Office also asserted that Claim 15 was unclear for the same reason. However, Applicants have also replaced the term "mantissa region" with the term "interval" in Claim 15.

The Office also asserted that "it is mis-descriptive by the limitation 'wherein log(x) is a function of a distance between the reference point $a_i$ and the binary mantissa m' in line 12 because variable 'x' is a single value of log of x as clearly cited in the claim line 10 (e.g., a value of log(x)...). Applicants do not understand the rejection and respectfully submit this term is not misdescriptive as asserted by the Office. Variable x is not a single value of log of x. Variable x is a variable, and log(x) is a function of x. Moreover, log(x) is a function of a distance between reference point $a_i$ and binary mantissa m (which is the mantissa of x) because whatever value x has determines the value of m, m necessarily has *some* distance from reference point $a_i$, and log(x) is a function of the distance of mantissa m from reference point $a_i$, because log(x) varies, depending upon what m is, and thus also varies depending upon the distance of m to $a_i$.

For the above reasons, it is submitted that Claims 15 and 31 as herein amended satisfy the requirements of 35 U.S.C. § 112, second paragraph.

Claims 2-3, 5-11, 13-14, 16-17, 19-25, 27-30, and 32-37 were rejected for being dependent upon Claims 15 and 31. Claims 5, 13, 19, 27, and 32-35 have been redrafted as independent claims incorporating the term "interval" instead of "mantissa region." Therefore, this rejection no longer applies to these claims.

Claims 2-3, 6-11, 14, 17, 20-25, 28-30, and 36-37 variously depend upon an independent claim that has been amended to recite "interval" instead of "mantissa region." When the recitations of Claims 2-3, 6-11, 14, 17, 20-25, 28-30, and 36-37 are considered in combination with their respective base claims, it is submitted that Claims 2-3, 6-11, 14, 17, 20-25, 28-30, and 36-37 likewise satisfy the requirements of 35 U.S.C. § 112, second paragraph.

For these reasons, it is submitted that the rejection of rejection of Claims 2-3, 5-11, 13-17, 19-25, and 27-37 under 35 U.S.C. § 112, second paragraph, should be withdrawn.

The rejection of Claims 2-3, 7, 15-17, 21, 31, and 36-37 under 35 U.S.C. § 103 as being unpatentable over Smith (U.S. Pat. No. 5,570,310) in view of Watson (U.S. Pat. No. 5,629,780) is respectfully traversed.

The Office asserts that Smith discloses a method for computing a natural logarithm function comprising the steps of partitioning a mantissa between 1 and 2 into N equally spaced sub-regions, precomputing a reference point ai of each of N equally spaced sub-regions where i=0 to N-1, selecting N sufficiently large so that the first degree polynomial in computation of log(m) results in a preselected degree of accuracy, and computing a value of log(x) for a binary floating point representation of x stored in a memory of a computing device. Although the Office asserts that the partitioning is into N "equally spaced" sub-regions, the Office also correctly admits on page 4 of the Office Action that Smith does not disclose that the precomputing point ai is the centerpoint of each subregion.

Applicants agree that Smith does not disclose that the precomputing point ai is the centerpoint of each subregion. However, Applicants believe that there are even more fundamental differences between the Office's assertions and what Smith actually teaches or suggests. Notably, Applicants believe that the partitioning of the interval between 1 and 2 only serves to produce a value of $a_i$. See Figure 1 of Smith at 40, 50, and 70, and Figure 3 at 220, 260, 290, 230, 330, 360, and both results 400 and 410. More specifically, the first N+1 bits of the fraction of x are extracted and identified as n at 220. This value of n is used to

determine an index i at 260, and the value of i is used to look up a value *a* indexed by i at 290. At 330, this value of *a* and a value y generated at 230 is used in a linear relationship to determine another value w, which is *not a logarithm.* The value w is used to evaluate a polynomial p(w) at 360, and then the product of w and p(w) plus another term is used to determine a result at either 400 or 410. However, as noted above, *w is not a logarithm.* Additionally, *p(w) is not a linear function, i.e., it is not a first degree polynomial.* See equation (18) at col. 5 near line 55, and col. 5, lines 55-67. Rather, p(w) is a sixth degree polynomial in w, which itself is a linear polynomial in y (see 330 in Figure 3). Therefore, p(w) is also a sixth degree polynomial in y. Even if p(w) were a linear function of y, which, according to equation (18), it is not, the logarithm generated in either case 400 or 410 of Figure 3 by the method described by Smith utilizes, the function w*p(w), which *must necessarily be at least a second degree polynomial in y* (w is a linear function of y, so that w*p(w) must be at least a second degree function of y).

Smith does show another value (-1-log(b[i])) being determined by index i at 280. Although this value admittedly contains a logarithm, it is certainly not the logarithm of a number x, nor is there any teaching or suggestion that it is a first degree polynomial in the binary mantissa m (i.e., y) of a number x. See equations (10) and (11) and 370 and 400 of Figure 3. However, even if (-1-log(b[i])) were a first degree polynomial of mantissa m of x, or could be refined by using a first degree polynomial of mantissa m of a number x, neither the result at 400 nor at 410 would be first degree polynomials of a number x.

For the above reasons, Smith does not teach or suggest computing a value of log(x) for a binary floating point representation of x utilizing a first degree polynomial in the binary mantissa m of x.

Watson adds nothing to Smith to teach or suggest computing a value of log(x) for a binary floating point representation of x utilizing a first degree polynomial in the binary mantissa m of x. Instead, Watson teaches only that a bisection method is typically used to determine whether to increment or decrement the initial matrices 35 entered into step 56 at

col. 10, lines 26-28. Let us assume, *arguendo*, that Watson teaches a method for determining a value using a mid-point within a region for minimizing the error, and the computation is used to generate an image, that Taylor series are well-known, and that a first order Taylor series would be used by one of ordinary skill in the art to minimize the computation process. Even with these assumptions, applying the teachings of Watson to Smith would not suggest computing a value of log(x) for a binary floating point representation of x utilizing a first degree polynomial in the binary mantissa m of x. To apply these teachings in Smith would be contrary to the fundamental principle of operation of the methods and devices disclosed in Smith, which is to find a logarithm using the equation cited in the Abstract [which is not a first degree polynomial in y, contrary to the assertion of the Office at page 8 of the Office Action, due to the logarithm function of (1+(ay-1))]. See also col. 3, lines 31-54. At most, one of ordinary skill in the art might be motivated only to use a first order Taylor series to modify the values retrieved for $a_i$ or perhaps (-1-log(b[i])) (although Smith and Watson are silent on the usage of Taylor series, and thus, even this motivation is open to question). And in that case, the result would still not be a first degree polynomial in the mantissa m of a number x.

By contrast, as amended herein, each of Applicants' independent Claims 5, 13, 19, 27, and 32-35 recites computing a value of log(x) for a binary floating point representation of x utilizing a first degree polynomial in the binary mantissa m of x or an apparatus configured to do so. Therefore, each of these claims is patentable over the combination of Smith and Watson. Claims 2-3, 7, 15-17, 21, 31, and 36-37 each depend, directly or indirectly, upon one of independent base Claims 5, 13, 19, 27, and 32-35. When the recitations of Claims 2-3, 7, 15-17, 21, 31, and 36-37 are considered in combination with the recitations of their respective base claims, it is submitted that Claims 2-3, 7, 15-17, 21, 31, and 36-37 are likewise patentable over the combination of Smith and Watson.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejections of Claims 2-3, 7, 15-17, 21, 31 and 36-37 be withdrawn.

The rejection of Claims 8-11, 22-25, and 29-30 under 35 U.S.C. § 103 as being unpatentable over Smith in view of Watson and further in view of Wallschlaeger (U.S. Pat. No. 5,345,381) is respectfully traversed.

Smith and Watson are described above.

Even assuming that Wallschlaeger teaches or suggests the use of a natural logarithm function in a tomography scanner as asserted by the Office, combining this teaching with the teachings of Smith and Watson as described above does not result in Applicants' invention as claimed in Applicants' independent claims. The deficiency in the combination is a result of a lack of a teaching or suggestion in Wallschlaeger to computing a value of log(x) for a binary floating point representation of x utilizing a first degree polynomial in the binary mantissa m of x.

Each of Applicants' independent Claims 5, 13, 19, 27, and 32-35 recites computing a value of log(x) for a binary floating point representation of x utilizing a first degree polynomial in the binary mantissa m of x or an apparatus configured to do so. Therefore, each of these claims is patentable over the combination of Smith, Watson, and Wallschlaeger. Claims 8-11, 22-25, and 29-30 each depend, directly or indirectly, upon one of independent base Claims 5, 13, 19, 27, and 32-35. When the recitations of Claims 8-11, 22-25, and 29-30 are considered in combination with the recitations of their respective base claims, it is submitted that Claims 8-11, 22-25, and 29-30 are likewise patentable over the combination of Smith, Watson, and Wallschlaeger.

For the reasons set forth above, Applicants respectfully request that the Section 103 rejections of Claims 8-11, 22-25, and 29-30 be withdrawn.

Claims 5-6, 13-14, 19-20, 27-28, and 32-35 were indicated by the Office as being allowable if amended to incorporate the recitations of the respective base claims and any respective intervening claims and to overcome the rejections under 35 U.S.C. 112, second paragraph. Claims 5, 13, 19, 27, and 32-35 have been rewritten in this manner and thus

should now be in condition for allowance. Claims 6, 14, 20, and 28 depend upon the now allowable Claims 5, 13, 19, and 27, respectively, and thus themselves should be allowable as written.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,

July 6, 2004

Alan Cassel

Alan L. Cassel
Registration No. 35,842
ARMSTRONG TEASDALE LLP
One Metropolitan Square, Suite 2600
St. Louis, Missouri 63102-2740
(314) 621-5070